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Incidence of Comorbidity in Type 2 Diabetes in Urban Population: A Review

[1]Laxmi Kumari Yadav & [2]Kalpana Kumari

[1]Assistant Professor, Zoology, S.P.C. Govt. College, Ajmer, Rajasthan, India

[2]Assistant Professor, Chemistry, S.P.C. Govt. College, Ajmer, Rajasthan, India

ABSTRACT: India has the second largest diabetic population in the world. The chronic nature of the disease and high prevalence of co-existing chronic medical conditions or "co morbidities" makes diabetes management complex for the patient and for health care providers. Hence a strong need was felt to explore the problem of co morbidity among diabetics and its dimensions in primary health care practices.

KEYWORDS: India, diabetic, population, comorbidity, type 2, urban, population, health care

I. INTRODUCTION

Globally the burden of diabetes mellitus (DM) is a major public health concern. According to the estimates of DM burden worldwide, 371 million people actually have DM and about 80% live in Low and Middle Income countries. The number of people expected to have DM by 2030 is over 550 million. The number of people living with diabetes in India has increased from 61 million in 2011 to 67 million in 2014[1]. India has the second largest diabetic population after China in the world. Apart from being a chronic debilitating disease the high prevalence of co-existing chronic medical conditions or "co morbidities" make diabetes management an arduous task for the patient and for health care providers. Prior studies have proved that most adults with diabetes have at least one co morbid condition and 40%have three or more co morbid conditions yet the perspective of the healthcare providers and treatment strategies are more oriented on management of diabetes alone[2].For optimal health care delivery and developing strategies that support self-management among the ever growing population of diabetes patients, we need to understand how the number, type, and severity of co morbidities influence these patients' diabetes management. In an already burdened health care system co morbid conditions may shift the providers' focus away from diabetes. Co morbidities may also serve as competing demands on patients' self-management resources, and potentially reduce the amount of time and energy left for diabetes self-care.Even conditions not directly related to diabetes, such as pain and depression, are more prevalent in diabetics, thus emphasizing the need to take into account both diabetes-related and non-diabetes related co morbidities.[3]

Table 1 explored the association of major comorbidities with diabetic patients according to demographic and socioeconomics characteristics. About thirty-one percent of the diabetics from rural area and twenty-six percent from urban areas had blood pressure. It is higher among males (31.3%) than females (24.9%). Diabetics aged 60 years and above reported 42% high blood pressure, which is significantly higher than the prevalence among aged 18–40 years (19.3%) and 41–59 years (15.3%). Association between marital status and high blood pressure morbidities was also found to be significant ($P < 0.01$). Prevalence of high blood pressure is higher among widowed, divorced, separated and never married respondents (40.9%) than among those who were currently married (25.1%). Moreover, significant association was found between education status of the respondents and their blood pressure ($P < 0.05$). Illiterate had high blood pressure (33.3%) than those had ten or more years of education (20.4%). In Muslims, prevalence of high blood pressure was found 36.7%, however, in Hindus was 26.3%. A significant association was found between working status and high blood pressure ailments ($P < 0.01$). A higher proportion of blood pressure (37.6%) was found in not working respondents whereas, it was 14% in farmer and daily wage workers.[4]

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Table 1. Comorbidities among diabetics by demographic and socio-economic characteristics.

Background characteristics	High Blood pressure	n	χ^2	p value	Cardiovascular disease	n	χ^2	p value
Rural	31.4	79	2	0.159	21.4	54	1.9	0.167
Urban	25.7	65			16.6	42		
Male	31.3	89	2.5	0.111	18.3	52	0.2	0.649
Female	24.9	55			19.9	44		
18–40	19.3	16	41.9	0.000	12.1	10	14.5	0.001
41–59	15.3	29			13.2	25		
60 and above	42.5	99			26.2	61		
Currently married	25.1	99	10.6	0.001	18.7	74	0.1	0.765
Widowed/divorced/separated/never married	40.9	45			20.0	22		
Illiterate	33.3	58	7.1	0.029	24.1	42	7.4	0.025
1–9 years	30.4	56			19.6	36		
10 and more years	20.4	30			12.2	18		
Hindu	26.3	94	3.9	0.144	18.4	66	0.3	0.866
Muslim	36.7	33			20.0	18		
Buddhist and other	29.8	17			21.1	12		
SC/ST	28.7	39	0.2	0.911	22.8	31	2.1	0.341
OBC	27.0	31			15.7	18		
General	29.1	74			18.5	47		
Not working	35.6	91	18	0.000	22.7	58	4.7	0.096
Farmer/daily wage labour	14.0	16			14.0	16		
Other	27.4	37			16.3	22		
Poor	29.2	49	0.4	0.828	19.1	32	0.3	0.869
Middle	29.6	50			20.1	34		
Rich	26.8	45			17.9	30		
Total	**28.5**	**144**			**19.0**	**96**		

Note: the 'n' is reported based on the multiple responses but the percentage is given based on the total sample size (n = 505) not the total responses (n = 535).

Nineteen percent of diabetics people suffering with cardiovascular diseases (CVDs). Proportion of CVDs was seen higher in rural (21.4%) than urban areas (16.6%). It was slightly different among women (19.9%) than men (18.3%). The result highlights have a significant association between age and prevalence of CVDs ($P < 0.01$). The prevalence of

CVDs was significantly varying by age groups. It was higher in age group 60 and above years (26.2%) than age group 18–40 years (12.1%).[5] The findings show significant association between educational status and cardiovascular diseases (P < 0.05). Illiterate had more cardiovascular diseases (24.1%) than those with ten or more years of education (12%). Furthermore, the prevalence of CVDs is more among SC/STs (22.8%) followed by OBC and general castes (15.7% and 18.5% respectively). Working status is significantly associated with CVDs ailments (P < 0.05). A larger proportion of diabetics, who were not working (22.7%) had CVDs than farmers and daily wage workers (14%).[6] The prevalence of CVDs was 19.1%, 20.1% and 17.9% respectively in poor, middle and rich class (Table 1).

II. DISCUSSION

There is no consensus on how to measure urbanisation at country level; few indicators have been suggested, providing different proxy measures. Data on urbanisation measured by urban percentage (UP), that is, the proportion of a population living in urban areas as defined by national statistical offices, was collected for 207 countries from the 2015 World Bank Development Indicators. UP, despite being the most commonly used and widely available measure because of its simplicity, relies on country-specific definition of what it is urban, potentially leading to different ranks of urbanisation when several countries are considered. As a consequence, also data on the agglomeration index (AI) in 2008 was obtained for 162 countries from The World Bank World Development Report.[7] AI is a composite measure of population density, size and travel time to the nearest urban city. Population density is based on the average of two global gridded population data sources—Global Rural-Urban Mapping Project and LandScan. Population size in a defined ‘large’ urban centre used for this analysis was 100 000 inhabitants. Travel time to the nearest urban city is calculated by a cost–distance model that estimates travel time to the city over the average travel speeds, based on GIS data, between the transport network and off road surfaces.[8] These components are aggregated, with the proportion of this number to that country’s total population being the AI. This measure is designed to quantify the degree of settlement concentration in order to capture the difference between large cities growing bigger from many small cities emerging. Also, AI includes only locations that satisfy all three components, transcending country-specific and ad hoc definition discrete entities, such as cities and administrative boundaries. However, AI is sensitive to the chosen threshold values used to define the components.[9]

Urbanisation, obesity and GDP were all positively associated with physical inactivity in a statistically significant way. Similarly, urbanisation, physical inactivity, sugar consumption and GDP were positively significantly associated with obesity. Urbanisation and GDP were also significantly associated with sugar consumption[10] (table 2).

In multivariate analyses, urbanisation measured either as UP or AI was found significantly and positively associated with sugar consumption and physical inactivity, but not with obesity. In turn, higher sugar consumption was significantly associated with higher obesity, and higher obesity was significantly associated with higher physical inactivity (table 2)

When all the variables were included in a final model, higher obesity prevalence, higher levels of physical inactivity and lower GDP were all significantly associated with higher prevalence of T2D, entirely accounting for the association between UP and T2D. Nonetheless, when urbanisation was measured by the AI, this remained positively statistically significantly associated with T2D in the final model and so did the intermediate variables (physical inactivity, obesity and GDP) [11] (table 2).

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Table 2

Linear regression coefficients and relative 95% CIs coming from crude models and from multivariate models investigating the association of independent variables in relation to T2D and intermediate variables (n=number of countries)

	Crude β coefficient (95% CI)		Adjusted (urban percentage) β coefficient (95% CI)		Adjusted (agglomeration index) β coefficient (95% CI)	
Variates	N	T2D	N	T2D	N	T2D
Urban percentage	207	0.048* (0.022 to 0.074)	126	−0.024 (−0.058 to 0.009)	–	–
Agglomeration index	162	0.082* (0.058 to 0.105)	–	–	109	0.054* (0.019 to 0.089)
Obesity	187	0.281* (0.233 to 0.329)	126	0.233* (0.149 to 0.317)	109	0.148* (0.052 to 0.244)
Physical inactivity	143	0.204* (0.142 to 0.265)	126	0.142* (0.085 to 0.199)	109	0.106* (0.045 to 0.167)
Sugar consumption	173	0.114* (0.075 to 0.152)	126	0.016 (−0.044 to 0.076)	109	0.011 (−0.056 to 0.078)
GDP per capita	183	0.020 (−0.018 to 0.057)	126	−0.060 (−0.103 to −0.017)	109	−0.069 (−0.108 to −0.031)
	N	Physical inactivity	N	Physical inactivity	N	Physical inactivity
Urban percentage	143	0.210* (0.136 to 0.283)	136	0.128* (0.033 to 0.224)	–	–
Agglomeration index	118	0·261* (0.185 to 0.336)	–	–	112	0.203* (0.111 to 0.295)
Obesity	141	0.461* (0.305 to 0.617)	136	0.359* (0.185 to 0.532)	112	0.216 (−0.006 to 0.437)
GDP per capita	138	0.182* (0.080 to 0.285)	136	−0.007 (−0.126 to 0.111)	112	0.025 (−0.082 to 0.132)

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Variates	Crude β coefficient (95% CI)		Adjusted (urban percentage) β coefficient (95% CI)		Adjusted (agglomeration index) β coefficient (95% CI)	
	N	T2D	N	T2D	N	T2D
	N	Obesity	N	Obesity	N	Obesity
Urban percentage	187	0.229* (0.170 to 0.288)	126	0.045 (−0.027 to 0.117)	–	–
Agglomeration index	153	0.234* (0.177 to 0.290)	–	–	109	0.040 (−0.031 to 0.110)
Physical inactivity	141	0.429* (0.284 to 0.574)	126	0.112 (−0.008 to 0.233)	109	0.109 (−0.012 to 0.231)
Sugar consumption	166	0.457* (0·388 to 0.525)	126	0.432* (0.328 to 0.535)	109	0.426* (0.317 to 0.534)
GDP per capita	178	0.236* (0.151 to 0.321)	126	−0.015 (−0.107 to 0.077)	109	0.020 (−0.059 to 0.981)
	N	Sugar consumption	N	Sugar consumption	N	Sugar consumption
Urban percentage	173	0.370* (0.283 to 0.457)	165	0.242* (0·.136 to 0.347)	–	–
Agglomeration index	148	0.375* (0.282 to 0.468)	–	–	143	0.280* (0.186 to 0.373)
GDP per capita	165	0.451* (0.339 to 0.563)	165	0.273* (0.141 to 0.404)	143	0.305* (0.193 to 0.417)

- ***p Value <0.005.**
- **GDP, gross domestic product; T2D, type 2 diabetes.**

III. RESULTS

While type 2 diabetes in India has been explored in many epidemiology and clinical studies, comparatively few have studied the anthropology of diabetes in India, and none have focused on rural regions.Diabetes is a growing public health concern in India and disadvantaged rural areas are increasingly affected. Although a number of studies draw attention to the prevalence and epidemiology of diabetes in rural regions, none provide qualitative data on perceptions and experiences of people with diabetes. Epidemiology and biomedical literature often blame ethnic predisposition and the 'nutrition transition'[12] (characterized by increased sedentarism, urbanization, and consumption of calorie-dense foods) for India's diabetes epidemic . Such rhetoric often emphasizes individual choices and factors that perpetuate the nutrition transition, such as rural-to-urban migration , wealth , dietary intake , and low physical activity , an approach that overlooks and eclipses the importance of structural social, economic, and political processes in perpetuating the nutrition transition and, subsequently, the diabetes epidemic[13]. Qualitative data are therefore crucial, not only to understand the impact of diabetes on lives and livelihoods but also to identify perceived structural factors contributing to the diabetes epidemic.

Participants perceived shifting dietary patterns as the primary driver of the diabetes epidemic and identified a number of processes that influenced food intake in recent years. Specifically, participants perceived the increasing presence of the PDS, which subsidizes rice, sugar, and cooking oil, as having an impact on the consumption of the products it provides. In addition, participants acknowledged the role of commercialization of agriculture in reducing the local availability of healthy traditional staples and creating a dependency on foods obtained outside the household. Finally, improved access to 'new' packaged and/or processed foods (such as sodas, candies, baked goods, etc.) [14]due to the expansion of the food processing sector and aggressive rural marketing, has increased consumption of high-fat and high-sugar foods. Therefore, if policymakers wish to combat the nutrition transition and the diabetes epidemic in rural regions of India, it would be prudent to examine these three political/economic drivers and identify opportunities to promote foods with higher fiber content and lower glycemic indices, while simultaneously reducing availability and consumption of 'hyperpalatable' foods.[15]

A common theme underlying perceived causes of diabetes and barriers to illness management was poverty. Participants often cited "tension" as a cause of diabetes, and "financial problems" were a common source of tension. Many other tensions were indirectly associated with poverty, such as infant mortality, injuries and infectious illness, and "family problems" induced by financial deficits, migrant labor, or other socioeconomic difficulties. Poverty was also considered a serious barrier to proper diabetes management due to the high costs associated with regular health check-ups, medication, and dietary control.[16] Finally, diabetes management often served to exacerbate poverty, as many participants were required to sell possessions or seek loans to pay for medical treatment of diabetes or associated complications. Thus, while diabetes is often considered a "disease of the affluent" in low-income countries, it is increasingly impacting the rural poor , and serves to exacerbate the financial difficulties of already-marginalized populations.[17]

While large-scale changes in political and socioeconomic processes may be required to alleviate the risks factors of diabetes in rural regions of India, culturally sensitive public health education and clinical practices remain important for prevention and proper illness management. Health education that acknowledges patients' illness perceptions is more likely to lead to positive behavior changes[18] . Given that the participants in this study trusted health professionals as their primary source of health information, we think that clinical check-ups are an opportunity to share appropriate information and advice with patients. The current study is therefore important for elucidating relevant cultural 'constructs' that can be used to develop public health programming and doctor-patient relationships that concord with patients' beliefs. These constructs include 'tradition' as an explanatory model; the lack of cultural acceptability of physical activity outside of work duties; stigmas associated with diabetes; perceived loss of autonomy upon diagnosis; ready acceptance of pharmaceutical regimens; and perceived redundancy of medication when diabetes is 'controlled.[19]' The importance of tension among participants suggests that health professionals may need to address the mental health dimensions of diabetes, both prior to and following diagnosis .

IV. CONCLUSIONS

The present study calls attention to the adverse impact of comorbid conditions on HRQL among diabetic patients. It reiterates the need for focused and comprehensive care for chronic conditions especially diabetes mellitus, which is associated with multiple complications and comorbidities. As accessible and affordable first level of care, primary health centers (PHCs) are ideally placed for management of multiple chronic conditions. However, in LMICs like India where most of the PHCs are ill-equipped,[20] the chronic disease care is generally fragmented and adds to the burden of chronic disease patients. The recent 'Health and Wellness Centre' (HWC) initiative of Government of India,[21] wherein existing PHCs shall be strengthened with facilities for comprehensive primary care to improve community access, is a step forward in the direction of continuity of care .However, other than screening and prevention programs, that is, existing National Programme for the Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke, due emphasis should also be placed on the curative and rehabilitative aspects of the chronic conditions.[22] As concluded in our study, diabetic patients with visual impairment and stroke have significantly reduced quality of life, hence more emphasis may be given to the rehabilitation of the sequelae of these diseases to reduce the burden and improve quality of life and health outcomes. [23]The provision of physiotherapist at PHCs under HWC initiative is a welcome step in this regard. MH counselors can play a significant role in addressing depression related to chronic conditions among these patients. Hence, we recommend the integration of National Mental Health Programme components for primary care with the HWC initiative that will help in improving the quality of life and health outcomes among diabetic patients.[24]

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